Generate Collection

L2: Entry 3 of 125 File: USPT Feb 25, 2003

DOCUMENT-IDENTIFIER: US 6526185 B1
TITLE: Image reading apparatus

Application Filing Date (1):
19971010

Detailed Description Text (3):
The image reading apparatus comprises an operation section 1, a document feeder 2 and a read section 3. The operation section 1 is provided to instruct an operation such as start of image reading and to set various values such as correction values for magnifying power and for document feed distance.

Detailed Description Text (4):
First, the operation section 1 is explained. The operation section 1 comprises start key 101 for starting read operation, ten-keys 102 for setting various values such as the correction values for magnifying power and for document feed distance, a display panel 103 for displaying the various values, and a non-volatile memory device 104 for storing the various values set with the ten-keys 102.

Detailed Description Text (6):
The correction values for magnifying power and for document feed distance stored in the non-volatile memory device 104 are read and sent to the controller 210 of the document reader 2 each time the electrical power source is turned on. The correction value for magnifying power is provided to correct an error of the magnifying power due to a difference in the mechanical parts among the automatic document feeders. The correction value for document feed distance is provided to correct an error of the document feed distance due to mechanical scattering among the document feed distance from the standby position G to the read position A in the document feeder 2 which should be the same design document feed distance. The correction values for magnifying power and for document feed distance are set and stored in the non-volatile memory device 104 for each automatic document feeder when it is assembled in a factory. By using the non-volatile memory device 104, it is not needed to set them each time the electrical power source is turned on. That is, they are read from the non-volatile memory device 104 when the electrical power source is turned on.

Detailed Description Text (14):
Next, the read section 3 is explained. A document is put on the platen glass 302 in the manual mode, and a document is fed onto the other platen glass 303 in the sheet-through mode. A white standard plate or shading correction plate 301 is provided at an end of the platen glass 302. A scanner unit 304 including a first mirror and a lamp as shown in FIG. 2 is moved by a scanner motor 308 along the subscan direction. A second mirror 305 and a third mirror 306 are moved also in the same direction. The lamp exposes a document, and a light reflected from a document on the platen glass 302 is reflected by the mirrors 304, 305 and 306 and transmits through a lens 307 onto a CCD unit 309, which converts optical signals to electrical analog signals. An image processor 310 converts the analog signals to digital image signals. Then, it performs various digital image processings such as shading correction and sends the obtained digital signals to an output apparatus such as a printer.

First Hit Fwd Refs

Generate Collection

L2: Entry 6 of 125 File: USPT Aug 13, 2002

DOCUMENT-IDENTIFIER: US 6433886 B1
TITLE: Image forming method and image forming apparatus

Abstract Text (1):
An image forming apparatus includes a document feeder having a stand on which documents are placed and a pair of guide members which move from a center of the stand to sides of the stand. The document feeder feeds a document such that the center of the document moves approximately along the center of the stand. An image reader reads the document to obtain document-shaped image data. An image processor has a memory region to store the document-shaped image data. The memory region has a width whose center approximately conforms with the center of the document-shaped image data. When the image processor conducts an image processing, the document-shaped image data is shifted toward one side of the memory region so that one side of the document-shaped image data is approximately conformed with a reference side of the memory region.

Application Filing Date (1):
19990826

Brief Summary Text (2):
The present invention relates to an image forming method and an image forming apparatus, and specifically to improvement in the relationship between the reference position in which an original document is read and its image processing.

Brief Summary Text (11):
In view of the above-mentioned technical problems, the present invention is accomplished. An object of the present invention is to provide an image forming method and an image forming apparatus in which an original document conveying means is employed, which is comprised of a pair of original document guides which are symmetrically widened from the center to both sides in equal amounts of movement, and the original document under conveyance is read, and when variable magnification process is carried out, no further complicated process is required.

Brief Summary Text (13):
An image forming apparatus comprises: a document feeder having a stand on which documents are placed and a pair of guide plates which move from a center of the stand to sides of the stand, whereby the document feeder feeds a document by using the pair of guide plates in such a way that the center of the document is moved approximately along the center of the stand; an image reader to read the document so as to obtain document-shaped image data; and an image processor having a memory region to store the document-shaped image data, the memory region having a width whose center is arranged to approximately conform with the center of the document-shaped image data; wherein when the image processor conducts an image processing, the image processor shifts the document-shaped image data toward one side of the memory region so that one side of the document-shaped image data is approximately conformed with a reference side of the memory region.

Brief Summary Text (14):
An image forming method, comprises steps of: feeding a document placed on a stand by using a pair of guide plates which move from a center of the stand to sides of

the stand in such a way that the center of the document is moved approximately along the center of the stand; reading an image on the document by a reading section so as to obtain document-shaped image data; and storing the document-shaped image data in a memory region having a width whose center is arranged to approximately conform with the center of the document-shaped image data; and shifting the document-shaped image data toward one side of the memory region when the image processor conducts an image processing so that one side of the document-shaped image data is approximately conformed with a reference side of the memory region.

Brief Summary Text (15):
Further, the above-mentioned problems may be solved by the following preferable structure and the following preferable method: (1) an image forming method characterized in that an original document is conveyed employing a pair of original document guides which are symmetrically widened from the center to both sides in equal amounts of movement, image data are generated while reading the original document under conveyance, and after shifting the generated image data of said original document to the reference edge, image processing is executed.

Brief Summary Text (16):
Furthermore, an image forming apparatus characterized in comprising an original document conveying means employing a pair of original document guides which are symmetrically widened from the center to both sides in equal amounts of movement, a reading means which reads the original document under conveyance employing the above-mentioned original document conveying means, and an image processing means which shifts the original document image data generated by the above-mentioned reading means to the reference edge, and executes image processing.

Drawing Description Text (2): e□134□ei.11.8□USERI□
□P□L SET RET□ON
□P□L SET DUPLE□□OFF
□P□L SET ECONOMODE□OFF
□P□L SET OUTBIN□UPPER
□P□L SET FINIS□□NONE
□P□L SET PAGEPROTECT□AUTO
□P□L SET PAPER□LETTER
□P□L SET □OLD□OFF
□P□L SET RESOLUTION□600
□P□L ENTER LANGUAGE□PCL

DOCUMENT-IDENTIFIER: US 6353455 B1
TITLE: Method of evaluating characteristics of a light beam, apparatus for evaluating the characteristics, and apparatus for adjusting a write unit by employing the evaluating method

Application Filing Date (1):
19990917

Brief Summary Text (3):
The present invention relates to an apparatus for evaluating an image formation device, such as a laser printer and a copying machine. More particularly, the invention relates to a method of evaluating characteristics required of a light beam which is emitted from the write unit of an image formation device toward a latent image carrier, such as a photosensitive drum and a photosensitive belt. The invention also relates to a light beam characteristic evaluation apparatus that is employed for evaluating the characteristics, and further relates to an apparatus for adjusting a write unit by employing the evaluation method.

Brief Summary Text (5):
Conventionally, an image forming device, such as a laser printer, a copying machine, and a facsimile device, performs writing on the surface of the photosensitive drum (latent image carrier) of an image forming unit by scanning the drum surface in both a horizontal scanning direction (i.e., main scanning direction) and a vertical scanning direction (i.e., sub-scanning direction) with a light beam emitted from a write unit, thereby forming an electrostatic latent image. In order to make the latent image visible and form a toner image, toner is caused to adhere to the surface of the photosensitive drum on which the latent image is formed. The toner image is transferred and fixed onto transfer paper. In this manner, an image is formed on the transfer paper.

Brief Summary Text (8):
For instance, in a copying machine, the image information on a manuscript is read in sequence and converted to a beam of light. In the case where the light beam writing position on the photosensitive drum surface deviates from a previously designed reference position, there arises a disadvantage that an image corresponding to the image information of a manuscript cannot be formed at the reference position. Particularly, in an image formation device, in which two laser light sources for emitting a beam of light are provided in the write unit and writing is performed on the photosensitive drum surface at two times the normal speed by scanning the photosensitive drum surface in the horizontal scanning direction concurrently with two light beams, if the writing position of one of the two light beams deviates from the writing position of the other light beam in the horizontal scanning direction, the image on a manuscript cannot be reproduced with high fidelity. Therefore, it is required to perform both the evaluation of the writing position of one light beam and the evaluation of the writing position of the other light beam.

Brief Summary Text (11):
Also, when two points on a manuscript in the horizontal scanning direction are extracted, two points on a copied image on transfer paper corresponding to the two

points on the manuscript are extracted, and the distance between the two points on the manuscript is compared with the distance between the two points on the copied image, they must be equal to each other as long as copying is performed with equimagnification. If the distance between two points on a manuscript is not exactly equal to the distance between two points on a copied image, this will result in a magnification error. Since an image cannot be reproduced with high fidelity on transfer paper, performing the evaluation of a magnification error is required. In addition, in the case of enlargement and reduction, a ratio of a copied image formed on transfer paper to an image on a manuscript has to be equal to a desired magnification or demagnification ratio. If these ratio differ from each other, an image cannot be reproduced with high fidelity and therefore the evaluation of a magnification error will also be required.

Brief Summary Text (17):
A pair of spaced photoelectric conversion elements 7a and 7b are provided in the horizontal scanning direction on a photosensitive surface 6 equivalent to the surface of a photosensitive drum provided in an image forming unit. In order to enhance received-light position accuracy (writing position accuracy), light intercepting plates 8a and 8b with a pinhole (circular small hole) are provided directly before the photoelectric conversion elements 7a and 7b. Let the distance between this pair of pinholes be L.

Brief Summary Text (21):
Next, in the case where the beam diameter of the light beam P1 on the surface of the photosensitive drum is offset from a previously designed value, the edge of an image formed on transfer paper will become dim, or cracks will occur in the scanning line, so that there is a disadvantage that picture quality will be degraded. Therefore, it is also required to evaluate the diameter or shape of the light beam on the scanned surface.

Brief Summary Text (68):
The foregoing objects are also accomplished by providing an adjustment method comprising the steps of: providing a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source; and moving the write unit relatively in a horizontal scanning direction against the latent image carrier in correspondence to an offset quantity of the light beam in the horizontal scanning direction, thereby adjusting the write unit.

Brief Summary Text (69):
The foregoing objects are also accomplished by providing an adjustment method comprising the steps of: providing a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source; and moving the write unit relatively in a horizontal scanning direction against an image forming unit incorporating at least the latent image carrier in correspondence to an offset quantity of the light beam in the horizontal scanning direction, thereby adjusting the write unit.

Brief Summary Text (70):
The foregoing objects are also accomplished by an adjustment apparatus comprising: a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source; an image forming unit incorporating at least the latent image carrier; and moving means for moving the write unit and the image forming unit relatively along a horizontal scanning direction in order to adjust an offset quantity of the light beam in the horizontal scanning direction.

Brief Summary Text (71):
The image forming unit may be provided with a developing unit.

Brief Summary Text (72):
The moving means may be constituted by a guide hole formed in a main body constitution wall of an image forming device and extending lengthwise in the horizontal scanning direction, and a support pin formed in either the write unit or the image forming unit and fitted into the guide hole.

Brief Summary Text (73):
The moving means may be constituted by an adjusting screw for moving either the write unit or the image forming unit in the horizontal scanning direction, and elastic means for urging either the write unit or image forming unit moved by the adjusting screw so that a point end of the adjusting screw abuts on the unit.

Brief Summary Text (74):
The moving means may be constituted by an adjusting screw for moving either the write unit or the image forming unit in the horizontal scanning direction and a boss portion provided in either the write unit or image forming unit moved by the adjusting screw, the adjusting screw meshing with the boss portion.

Brief Summary Text (75):
The foregoing objects are also accomplished by an adjustment method wherein a write unit, incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source, is adjusted by moving the write unit relatively in a vertical scanning direction against the latent image carrier in correspondence to an offset quantity of the light beam in the vertical scanning direction, the vertical scanning direction being defined as a direction perpendicular to both a traveling direction of a light beam which is incident from the write unit toward the image forming unit and a horizontal direction.

Brief Summary Text (76):
The foregoing objects are also accomplished by an adjustment method wherein a write unit, incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source, is adjusted by moving the write unit relatively in a vertical scanning direction against an image forming unit incorporating at least the latent image carrier in correspondence to an offset quantity of the light beam in the vertical scanning direction, the vertical scanning direction being defined as a direction perpendicular to both a traveling direction of a light beam which is incident from the write unit toward the image forming unit and a horizontal direction.

Brief Summary Text (77):
The foregoing objects are also accomplished by an adjustment apparatus comprising: a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source; an image forming unit incorporating at least the latent image carrier; and moving means for moving the write unit and the image forming unit relatively along a vertical scanning direction defined as a direction perpendicular to both a traveling direction of a light beam which is incident from the write unit toward the image forming unit and a horizontal direction in order to adjust an offset quantity of the light beam in the vertical scanning direction.

Brief Summary Text (78):
The image forming unit may be provided with a developing unit.

Brief Summary Text (79):
The moving means may be constituted by a guide hole formed in a main body constitution wall of an image forming device and extending lengthwise in the vertical scanning direction, and a support pin formed in either the write unit or

the image forming unit and fitted into the guide hole.

Brief Summary Text (80):
The moving means may be constituted by an adjusting screw for moving either the write unit or the image forming unit in the vertical scanning direction and elastic means provided in either the write unit or image forming unit moved by the adjusting screw, the elastic means being used for urging the moved unit so that a point end of the adjusting screw abuts on the unit.

Brief Summary Text (81):
The moving means may be constituted by an adjusting screw for moving either the write unit or the image forming unit in the vertical scanning direction and a boss portion provided in either the write unit or image forming unit moved by the adjusting screw, the adjusting screw meshing with the boss portion.

Brief Summary Text (82):
The foregoing objects are also accomplished by an adjustment method comprising the steps of: providing a write unit which incorporates both an optical scanning system and a synchronous sensor for determining a write timing period with respect to a latent image carrier in order to form an electrostatic latent image on a surface of the latent image carrier by a light beam emitted from a laser light source; and moving the synchronous sensor in a horizontal direction in correspondence to an offset quantity of the light beam of the write unit with respect to the latent image carrier in the horizontal scanning direction, thereby adjusting the offset quantity.

Brief Summary Text (83):
The foregoing objects are also accomplished by an adjustment apparatus comprising: a write unit incorporating both an optical scanning system and a synchronous sensor for determining a write timing period with respect to a latent image carrier in order to form an electrostatic latent image on a surface of the latent image carrier by a light beam emitted from a laser light source; and moving means for moving the synchronous sensor in a horizontal scanning direction in order to adjust an offset quantity of the light beam of the write unit with respect to the latent image carrier in the horizontal scanning direction.

Brief Summary Text (92):
The foregoing objects are also accomplished by an adjustment method wherein at least either an image forming unit or a write unit is moved so that a space therebetween is increased or decreased, in order to adjust an optical path length between a laser light source and a writing object surface of the image forming unit and based on a beam waist position correction quantity obtained by a light beam characteristic evaluation method comprising the steps of: (a) lighting the laser light source of a light beam which is employed to scan the writing object surface of the image forming unit linearly during a scanning period equivalent to 1 dot; (b) moving an area-type solid-state imaging element which detects the light beam in order along a traveling direction of the light beam with the writing object surface as a reference position, thereby obtaining a beam image at each position by the area-type solid-state imaging element; (c) based on each beam image obtained by the area-type solid-state imaging element at each position in a traveling direction of the light beam, computing a beam diameter at the each position of the light beam and thereby computing a beam diameter with respect to a depth direction; (d) from the beam diameter and a depth, computing a depth curve representative of a relation of the beam diameter to the depth; (e) specifying a beam waist position on the basis of the depth curve; and (f) from a difference between the beam waist position and the reference position, computing the beam waist position correction quantity.

Brief Summary Text (93):
The foregoing objects are also accomplished by an adjustment apparatus which comprises optical path length adjustment means for moving at least either an image

forming unit or a write unit so that a space therebetween is increased or decreased, in order to adjust an optical path length between a laser light source and a writing object surface of the image forming unit and based on a beam waist position correction quantity obtained by a light beam characteristic evaluation method comprising the steps of: (a) lighting the laser light source of a light beam which is employed to scan the writing object surface of the image forming unit linearly during a scanning period equivalent to 1 dot; (b) moving an area-type solid-state imaging element which detects the light beam in order along a traveling direction of the light beam with the writing object surface as a reference position, thereby obtaining a beam image at each position by the area-type solid-state imaging element; (c) based on each beam image obtained by the area-type solid-state imaging element at each position in a traveling direction of the light beam, computing a beam diameter at the each position of the light beam and thereby computing a beam diameter with respect to a depth direction; (d) from the beam diameter and a depth, computing a depth curve representative of a relation of the beam diameter to the depth; (e) specifying a beam waist position on the basis of the depth curve; and (f) from a difference between the beam waist position and the reference position, computing the beam waist position correction quantity.

Brief Summary Text (94):
In order to change an optical path length between a surface of a latent image carrier of the image forming unit and the write unit, the optical path length adjustment means may be constituted by a guide hole formed in a main body constitution wall of an image forming device and a guide pin formed in either the write unit or the image forming unit and fitted into the guide hole.

Brief Summary Text (97):
The laser light source may be equipped with a semiconductor laser for emitting a light beam, a collimator lens for collimating the light beam, and a lens barrel for holding the collimator lens. The lens barrel may be formed with a first screw portion along an optical axis direction. The constitution wall of the write unit may be formed with a second screw portion at a position at which the lens barrel is arranged, the first screw portion meshing with the second screw portion. The optical path length adjustment means may be constituted by the first and second screw portions.

Brief Summary Text (98):
The foregoing objects are also accomplished by a light beam characteristic evaluation apparatus which is employed in a method of evaluating characteristics required of a light beam by forming the light beam on an area-type imaging element installed on a first surface equivalent to a second surface to be scanned, the light beam being emitted from a laser light source which is employed to scan the second surface linearly, the light beam characteristic evaluation apparatus comprising: a reference laser light source for determining previously designed reference positions of the light beam present on the second surface in horizontal and vertical scanning directions; a holder member for holding the reference laser light source; an angular position determination member for holding the holder member so that the holder member is rotatable and determining a rotational angular position of the reference laser light source; and a positioning reference base for positioning the angular position determination member so that a center of rotation of the holder member is aligned with a previously designed emission line of the light beam; wherein a reference pixel equivalent to the reference position on the area-type imaging element is specified, by rotating the holder member on the center of rotation and receiving a reference light beam emitted from the reference laser light source at at least two rotational angular positions with the area-type imaging element.

Brief Summary Text (103):
The foregoing objects are also accomplished by a light beam characteristic evaluation apparatus which is employed in a method of evaluating characteristics

required of a light beam by forming the light beam on an area-type imaging element installed on a first surface equivalent to a second surface to be scanned, the light beam being emitted from a laser light source provided in a write unit having an optical scanning system for linearly scanning the second surface of a latent image carrier provided in an image forming unit, the light beam characteristic evaluation apparatus comprising: a positioning member for positioning the write unit with respect to the image forming unit; a reference laser light source for determining previously designed reference positions of a light beam on the second surface in horizontal and vertical scanning directions, the light beam being emitted from the laser light source; a holder member for holding the reference laser light source; an angular position determination member for holding the holder member so that the holder member is rotatable and determining a rotational angular position of the reference laser light source; and a positioning reference base for positioning the angular position determination member so that a center of rotation of the holder member is aligned with a previously designed emission line of the light beam emitted from the write unit, the positioning reference base being provided in a positioning base; wherein a reference pixel equivalent to the reference position on the area-type imaging element is specified, by rotating the holder member on the center of rotation and receiving a reference light beam emitted from the reference. laser light source at at least two rotational angular positions with the area-type imaging element.

Brief Summary Text (107):
The foregoing objects are also accomplished by a light beam characteristic evaluation apparatus which is employed in an evaluation method comprising the steps of: lighting a laser light source during a scanning period equivalent to 1 dot during scanning, the laser light source being provided in a write unit having an optical scanning system for linearly scanning a first surface of a latent image carrier of an image forming unit; forming the light beam on at least two or more area-type imaging elements spaced in a horizontal scanning direction and provided on a second surface equivalent to the first surface to be scanned; and evaluating characteristics required of the light beam; the light beam characteristic evaluation apparatus comprising: a positioning member for positioning the write unit with respect to the image forming unit; a reference laser light source for determining previously designed reference positions of a light beam on the first surface in horizontal and vertical scanning directions, the light beam being emitted from the laser light source; a cylindrical holder member for holding the reference laser light source; angular position determination members for determining a rotational angular position of the reference laser light source, the determination members having a circular fitting hole into which the cylindrical holder member is rotatably fitted; and a positioning reference base for positioning the angular position determination members so that a center of rotation of the cylindrical holder member is aligned with a previously designed emission line of the light beam emitted from the write unit, the positioning reference base being provided in a positioning base; wherein a reference pixel equivalent to the reference position on the area-type imaging element is specified, by rotating the cylindrical holder member and receiving a reference light beam emitted from the reference laser light source at at least two rotational angular positions with the area-type imaging elements.

Drawing Description Text (11):
FIG. 9 is a diagram showing beam spots formed on the area-type imaging elements of the CCD cameras shown in FIG. 5;

Drawing Description Text (16):
FIG. 14 is an explanatory diagram of the beam spot (laser spot) formed on the area-type imaging element of the CCD camera shown in FIG. 12;

Drawing Description Text (35):
FIG. 23 is an explanatory diagram of structure 1 for adjusting a writing position

in a horizontal scanning direction by moving a write unit or an image forming unit, showing the relative positional relation between the write unit and the image forming unit;

Drawing Description Text (36):
FIG. 24 is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the horizontal scanning direction;

Drawing Description Text (37):
FIG. 25 is an explanatory diagram of structure 2 for adjusting a writing position in the horizontal scanning direction by moving the write unit or the image forming unit, and is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the horizontal scanning direction;

Drawing Description Text (38):
FIG. 26 is an explanatory diagram of structure 3 for adjusting a writing position in the horizontal scanning direction by moving the write unit or the image forming unit, and is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the horizontal scanning direction;

Drawing Description Text (39):
FIG. 27 is an explanatory diagram of structure 4 for adjusting a writing position in the horizontal scanning direction by moving the write unit or the image forming unit, and is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the horizontal scanning direction;

Drawing Description Text (40):
FIG. 28 is an explanatory diagram of structure 5 for adjusting a writing position in the horizontal scanning direction by moving the write unit or the image forming unit, and is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the horizontal scanning direction;

Drawing Description Text (41):
FIG. 29 is an explanatory diagram of structure for adjusting a writing position in a vertical scanning direction by moving the write unit or the image forming unit, and is an explanatory diagram showing the state in which the center of a light beam is offset from a reference position present on a writing start side in the vertical scanning direction;

Drawing Description Text (42):
FIG. 30 is an explanatory diagram of structure for adjusting a writing position in the vertical scanning direction by moving the write unit or the image forming unit, and is a partially sectional conceptual view showing an adjustment structure which adjusts writing start timing by moving the image forming unit relatively against the write unit shown in FIG. 23 in the vertical scanning direction;

Drawing Description Text (46):
FIG. 33 is an explanatory diagram of structure 1 for adjusting a depth by means of a write unit or an image forming unit, and is a partially sectional view showing an optical path length adjustment structure which adjusts an optical path length by adjusting the gap between the write unit and the image forming unit, based on the depth curve obtained by the light beam characteristic evaluation apparatus shown in the fourth embodiment of the present invention;

Drawing Description Text (47):

FIG. 34 is an explanatory diagram of structure 2 for adjusting a depth by means of the write unit or the image forming unit, and is a partially sectional view showing an optical path length adjustment structure which adjusts an optical path length by adjusting the gap between the write unit and the image forming unit, based on the depth curve obtained by the light beam characteristic evaluation apparatus shown in the fourth embodiment of the present invention;

Drawing Description Text (48):
FIG. 35 shows a detailed structure of the evaluation apparatuses 1-4, and is a side view showing the mounted state of the write unit onto an image forming device;

Drawing Description Text (49):
FIG. 36 is a plan view showing the mounted state of the write unit onto the image forming device;

Drawing Description Text (51):
FIG. 38 is a front view showing the mounted state of the write unit onto the image forming device;

Drawing Description Text (67):
FIG. 46 is a plan view showing the mounted state of a write unit onto an image forming device;

Drawing Description Text (68):
FIG. 47 is a side view showing the mounted state of the write unit onto the image forming device and also showing the state before the write unit is clamped;

Drawing Description Text (73):
FIG. 52(a) is an explanatory diagram of a structure for adjusting a writing position in the horizontal scanning direction by moving a sheet loading position, and is a schematic view of the inner construction of an image forming unit;

Detailed Description Text (6):
The laser light source section Sou, polygon mirror 19, reflecting mirrors 21 and 22, f.theta. lens 23, and reflecting mirror 24 are mounted in the write unit 1. The photosensitive drum 25 is mounted in an image forming unit (described later).

Detailed Description Text (18):
By writing a light beam many times along the horizontal scanning direction, a desired image is formed. The polygon mirror 19 is formed with six mirrors, and writing is performed by reflecting a light beam with the six mirrors. For this reason, there are cases where a position at which a light beam is written changes depending upon an accuracy in each mirror.

Detailed Description Text (27):
By writing a light beam many times along the horizontal scanning direction, a desired image is formed. The polygon mirror 19 is formed with six mirrors, and writing is performed by reflecting a light beam with the six mirrors. For this reason, there are cases where a position at which a light beam is written changes depending upon an accuracy in each mirror.

Detailed Description Text (64):
In more detail, the CCD cameras 32 to 34 are disposed at a light irradiation start position (of the sheet maximum size), light irradiation completion position, and intermediate position of a light-irradiated member (i.e., latent image carrier) upon which a light beam is cast which has been emitted from a write unit provided in an image forming apparatus (e.g., a copying machine). In this way, a position to be used in practice can be evaluated.

Detailed Description Text (73):

h e b b g e e e f e e g

Thus, if the laser-diode 11 or 12 is lit during a scanning period equivalent to 1 dot during scanning by the 1-dot lighting control circuit 35, as shown in FIG. 9, beam spots S will be formed on the area-type imaging elements 32a to 34a.

Detailed Description Text (85):
Therefore, if the laser light source section Sou is put out during the period from the detection of the synchronous clock pulse by the synchronous sensor 27 to the scanning period T and if the laser light source section Sou is lit during the 1-dot scanning period t by the 1-dot lighting control circuit 35 at the same time as the elapse of the scanning period T, the laser spot S equivalent to 1 dot can be formed on the area-type imaging element 43a of the CCD camera 43a during scanning, as shown in FIG. 14.

Detailed Description Text (109):
FIGS. 35 and 36 show the mounted state of a write unit 1 onto an image forming device. Reference numeral 100 denotes the base of the image forming device. To this base 100 a write unit positioning member 101 is fixed as shown in FIGS. 35 and 36.

Detailed Description Text (110):
The write unit 1 has an exterior configuration shown in FIG. 37. One side wall of this write unit 1 is provided with positioning protrusions 102 and 102, while the other side wall is provided with positioning holes 103 and 103. This write unit 1 is formed with a long and narrow slit hole 104' extending in the horizontal scanning direction. From this long and narrow slit hole 104' a laser beam P1 is emitted toward a photosensitive drum (not shown).

Detailed Description Text (111):
The write unit positioning member 101 has standing wall portions 104 and 105. as shown in FIGS. 36, 38, and 39. The first standing wall portion 104 is formed with a through hole 106, while the second standing wall portion 105 have positioning pins 107 rigidly attached thereto. The exterior wall 108 of the second standing wall portion 105 constitutes a surface for positioning the write unit 1 in the horizontal scanning direction. The point end portion of the write unit positioning member 101 serves as a reference base attaching portion 109 as shown in FIG. 39. Reference base attaching pins 110 are protruded from the reference base attaching portion 109.

Detailed Description Text (112):
To this reference base attaching portion 109 a positioning reference base 111 shown in FIGS. 40(a) through 40(d) is attached. This positioning reference base 111 extends lengthwise in the horizontal scanning direction. The upper surface of the positioning reference base 111 is formed with positioning pins 112 and positioning block attaching holes 113. The lower portion of the positioning reference base 111 is formed with fitting holes 114 into which the reference base attaching pins 110 are fitted.

Detailed Description Text (113):
The upper surface of the positioning reference base 111 is inclined, and on this upper surface, standing plate portions 113a are spaced and formed in the longitudinal direction. As shown in FIG. 41, a positioning block member 115 is attached to the upper surface of the positioning reference base 111 and serves as an angular positioning determination member. In this embodiment, this positioning block member 115 has standing plate portions 116 and 117 and a flat plate portion 118 as shown in FIGS. 42(a) through 42(d). As shown in FIG. 41, an LD holder plate 119 as a cylindrical holder member is attached to the standing plate 116. The standing plate 116 is formed with a circular fitting hole 120, and an engagement pin 121 is rigidly attached to the standing plate 116. The second standing plate 117 is formed with an abutting portion 117a which is engaged by a CCD camera. The abutting portion 117a is formed with a throughhole 122. The circular fitting hole 120 is finished into a precisely true circular shape.

Detailed Description Text (114):
The LD holder plate 119 is formed with a cylindrical boss portion 123 as shown in FIG. 43(a). The exterior shape of this cylindrical boss portion 123 is also finished precisely. The cylindrical boss portion 123 is fitted into the circular fitting hole 120. The disc portion 119a of the LD holder plate 119, as shown in FIG. 43(b), is formed with laser diode positioning holes 124, later diode attaching holes 125, and angular positioning determination engagement holes 126. In this embodiment, the angular positioning determination engagement holes 126 are provided around the cylindrical boss portion 123 at intervals of 90 degrees.

Detailed Description Text (116):
The slidable base 131 is formed with a bent plate portion 134 as shown in FIG. 35. The bent plate portion 134 is formed with an elongated hole 135 extending in the sliding direction of the slidable base 131. The CCD camera unit 130 is adjusted in the sliding direction by the micrometer 133 so that the imaging surface of the area-type imaging element 130a is located at the surface 31 equivalent to the surface of the photosensitive drum to be scanned. Then, the CCD camera unit 130 is locked to the support base 129 by tightening the bent plate portion 134 with a locking screw 136.

Detailed Description Text (138):
FIGS. 46 through 51 show a variation of the aforementioned detailed structure. FIGS. 46 through 48 show the attached state of a write unit 1 to an image forming device. Columns 140 are stood up in a base 100. To the upper ends of the columns 140 a write unit positioning member 101 is fixed. In this variation, the write unit positioning member 101 is constituted by a flat plate. The write unit positioning member 101 is formed with an opening 141 at the center thereof. The write unit positioning member 101 is provided with three clamp devices 142. Each clamp device 142 has a clamp lever 143. The write unit 1 is fixed to the write unit positioning member 101 by the clamp devices 142. An attaching base 128 is fixed to the base 100. To the attaching base 128 a support base 129 is fixed. The support base 129 is provided with a slidable base 131.

Detailed Description Text (140):
As shown in FIG. 49, a clamp frame 144 is fixed to the support base 129. The slidable base 131 is formed with a guide hole 145 extending in the sliding direction of the slidable base 131. The slidable base 131 is locked to the support base 129 by tightening a locking screw 136.

Detailed Description Text (141):
As shown in FIG. 50, a positioning reference base 111 is attached to the write unit positioning member 101. This positioning reference base 111 is fixed to the write unit positioning member 101 by the clamp device 142. The lower portion of this positioning reference base 111 is formed with an abutting portion 147. As shown in FIG. 51, a positioning block member 115 is attached to the upper portion of this positioning reference base 111.

Detailed Description Text (142):
The angular positioning block member 115 is formed with a circular fitting hole 120 and an engagement pin 121. To this angular positioning member 115 an LD holder plate 119 is attached. To this LD holder plate 119 a reference laser diode 127 is attached. The center of the circular fitting hole 120 is oriented in the same direction as a previously designed emission locus Qn.

Detailed Description Text (150):
This synchronous sensor 27, as shown in FIG. 21, is attached to a movable body 47. The movable body 47 is provided on a guide shaft 48 so that it is movable along the guide shaft 48, the guide shaft 48 extending in the horizontal scanning direction Q1. The guide shaft 48 is extended between constitution walls 49 and 49'

constituting part of a write unit 1. The constitution wall 49 is provided with an adjusting screw 50, which in turn meshes with a screw portion 51 formed in the constitution wall 49.

Detailed Description Text (153):
(Structure 1 for adjusting a writing position in the horizontal scanning direction by the movement of the write unit or the image forming unit)

Detailed Description Text (154):
Although the above-mentioned example performs the write timing correction of a writing start position by moving the synchronous sensor 27 in the horizontal scanning direction, this variation performs the adjustment of write timing by moving a write unit 1 and an image forming unit 53 relatively in the horizontal scanning direction Q1.

Detailed Description Text (155):
FIG. 23 shows the positional relation between the write unit 1 and the image forming unit 53. In this embodiment, at least the image forming unit 53 is provided with a developing roller unit 54, a transferring unit 55, and a charging unit 56 in the rotational area of a photosensitive drum 25. Note that the transferring unit 55 and the charging unit 56 may be formed integrally with each other. Also, the cleaning means and discharging means (not show) for the latent image carrier may be provided integrally with the image forming unit 53. Note that the vertical scanning direction Q3 is perpendicular to the optical axis of a light beam cast on the photosensitive drum 25.

Detailed Description Text (156):
The main body constitution wall 57 of the image forming device, as shown in FIG. 24, is formed with guide holes 58 extending lengthwise in the horizontal scanning direction Q1. The image forming unit constitution wall 53a constituting the image forming unit 53 is provided with protruding support pins 53b and a protruding boss portion 53c. The boss portion 53c is formed with a screw portion 53d. The support pins 53b are fitted in the guide holes 58, respectively.

Detailed Description Text (157):
The main body constitution wall 57 is provided with an adjusting screw 59, which in turn meshes with the screw portion 53d of the boss portion 53c. If the adjusting screw 59 is adjusted, the image forming unit 53 will be moved in the horizontal scanning direction Q1 relatively against the write unit 1, whereby the position of the light beam P1 will be adjusted in the horizontal scanning direction Q1 with respect to the image forming unit 53 (or the photosensitive drum 25). With this adjustment, the write timing correction of the previously designed writing start position is performed in the horizontal scanning direction.

Detailed Description Text (158):
(Structure 2 for adjusting a writing position in the horizontal scanning direction by the movement of the write unit or the image forming unit)

Detailed Description Text (159):
In Structure 1, the image forming unit 53 is moved in the horizontal scanning direction Q1 by adjusting the adjusting screw 59 meshing with the screw portion 53d of the boss portion 53c, whereby the position of the light beam P1 with respect to the image forming unit 53 is adjusted in the horizontal scanning direction Q1. However, in this variation, as shown in FIG. 25, the image forming unit 53 is mounted on a guide rail 60 extending in the horizontal scanning direction Q1 and is movable in the horizontal scanning direction Q1. The image forming unit 53 is urged toward the main body constitution wall 57 by an elastic member such as a spring 61. The adjusting screw 59 meshes with a screw portion 62 formed in the main body constitution wall 57. The point end portion 59a of the adjusting screw 59 abuts on the image forming unit constitution wall 53a of the image forming unit 53.

Detailed Description Text (160):
If the adjusting screw 59 is rotated in a direction which weakens the pushing force of the point end portion 59a of the adjusting screw 59 to the image forming unit constitution wall 53a, the image forming unit 53 will be moved in a direction of arrow a1 by the urging force of the spring 61. On the other hand, if the adjusting screw 59 is rotated in the opposite direction which increases the pushing force of the point end portion 59a of the adjusting screw 59 to the image forming unit constitution wall 53a, the image forming unit 53 will be moved in a direction of arrow a2 against the urging force of the spring 61 by the pushing force of the adjusting screw 59. With this movement, the position of the light beam P1 with respect to the image forming unit 53 is adjusted in the horizontal scanning direction Q1.

Detailed Description Text (161):
(Structure 3 for adjusting a writing position in the horizontal scanning direction by the movement of the write unit or the image forming unit)

Detailed Description Text (162):
In Structure 3, as shown in FIG. 26, the image forming unit 53 is mounted on the guide rail 60 extending in the horizontal scanning direction Q1 and is movable in the horizontal scanning direction Q1. In addition, the image forming unit 53 is formed with a rack portion 63. On the other hand, the main body constitution wall 57 is provided with an adjusting shaft 64 having a control knob portion. The shaft portion of the adjusting shaft 64 is provided with a pinion 65, which in turn meshes with the rack portion 63. The mesh between the pinion 65 and the rack portion 63 makes it possible to move the image forming unit 53 in the horizontal scanning direction Q1.

Detailed Description Text (163):
(Structure 4 for adjusting a writing position in the horizontal scanning direction by the movement of the write unit or the image forming unit)

Detailed Description Text (164):
As previously described, Structure 1 to Structure 3 have performed the positioning of the light beam P1 to the image forming unit 53 by moving the image forming unit 53 in the horizontal scanning direction Q1. But, this variation, as shown in FIG. 27, performs the positioning of the light beam P1 to the image forming unit 53 by moving the write unit 1 in the horizontal scanning direction Q1, while the image forming unit 53 remains stationary. The main body constitution wall 57 is provided with guide holes 66 at places corresponding to the write unit 1, the guide holes 66 extending lengthwise in the horizontal scanning direction Q1. The write unit constitution wall 1b is provided with protruding support pins 67 and a protruding boss portion 68. The boss portion 68 is formed with a screw portion 69, and the support pins 67 are fitted into the guide holes 66.

Detailed Description Text (165):
The main body constitution wall 57 is provided with an adjusting screw 70, which in turn meshes with the screw portion 69 of the boss portion 68. If the adjusting screw 70 is adjusted, the write unit 1 will be moved in the horizontal scanning direction Q1 relatively against the image forming unit 53, whereby the position of the light beam P1 will be adjusted in the horizontal scanning direction Q1 with respect to the image forming unit 53.

Detailed Description Text (166):
(Structure 5 for adjusting a writing position in the horizontal scanning direction by the movement of the write unit or the image forming unit).

Detailed Description Text (167):
As previously described, Structure 1 to Structure 4 have performed the positioning

of the light beam P1 to the image forming unit 53 in the horizontal scanning direction Q1 by providing the image forming unit 53 downward and the write unit 1 upward. But, this variation performs the positioning of the light beam P1 to the image forming unit 53 in the horizontal scanning direction Q1 by providing the write unit 1 downward and the image forming unit 53 upward.

Detailed Description Text (168):
As shown in FIG. 28, the image forming unit 53 is stationary, while the write unit 1 is mounted on a guide rail 71 extending in the horizontal scanning direction Q1 so that it is movable. The write unit 1 is urged toward the main body constitution wall 57 by a spring 72. The adjusting screw 74 meshes with a screw hole 73 formed in the main body constitution wall 57. The point end portion 74a of the adjusting screw 74 abuts on the write unit constitution wall 1b.

Detailed Description Text (169):
If the adjusting screw 74 is rotated in a direction which weakens the pushing force of the point end portion 74a of the adjusting screw 74 to the write unit constitution wall 1b, the write unit 1 will be moved in a direction of arrow a3 by the urging force of the spring 72. On the other hand, if the adjusting screw 74 is rotated in the opposite direction which increases the pushing force of the point end portion 74a of the adjusting screw 74 to the write unit constitution wall 1b, the write unit 1 will be moved in a direction of arrow a4 against the urging force of the spring 72 by the pushing force of the adjusting screw 74. With this movement, the position of the light beam P1 to the image forming unit 53 is adjusted in the horizontal scanning direction Q1.

Detailed Description Text (174):
The image forming unit 53 is provided with sheet loading trays 100 and 101. To the sheet loading tray 100 a side guide fixing plate attaching portion 102 is attached. This side guide fixing plate attaching portion 102 is provided with a side guide fixing plate 103. To this side guide fixing plate 103 a side guide 104 is attached so that it is slidable according to sheet size. The sliding direction of the side guide 104 corresponds to the horizontal scanning direction (perpendicular to a sheet conveying direction).

Detailed Description Text (178):
(Structure for adjusting a writing position in the vertical scanning direction by the movement of the write unit or image forming unit)

Detailed Description Text (180):
That is, this positional adjustment structure adjusts write timing by moving the write unit 1 and the image forming unit 53 relatively in the vertical scanning direction Q3.

Detailed Description Text (182):
The main body constitution wall 57, as shown in FIG. 30, is provided with an adjusting screw 75 constituting part of a moving means and is formed with guide holes 76 extending in the vertical scanning direction Q3. The write unit 1 is provided with support pins 77 and is formed with a boss portion 78. The boss portion 78 is formed with a screw portion 79. The adjusting screw 75 meshes with the screw portion 79 of the boss portion 79. If the adjusting screw 75 is adjusted, the write unit 1 will be moved in the vertical scanning direction Q3 relatively against the image forming unit 53. With this movement, the position of the light beam P1 is adjusted in the vertical scanning direction Q3 with respect to the image forming unit 53.

Detailed Description Text (183):
In this adjustment structure, although the position of the light beam P1 is adjusted in the vertical scanning direction Q3 with respect to the image forming unit 53 by moving the write unit 1 in the vertical scanning direction Q3, the

position of the light beam P1 to the image forming unit 53 may be adjusted by moving the image forming unit 53 in the vertical scanning direction Q3. In this case, the image forming unit 53 is formed with support pins 76 and a boss portion 78 which constitute part of a moving means.

Detailed Description Text (187):
A base 81 for attaching the laser diode 11 (12) is fixed to the write unit constitution wall 1b by means of screws 82. This attaching base 81 is provided with an attaching hole 83 for the laser diode 11 (12) and an attaching hole 84 for the collimator lens 13 (14). The laser diode 11 (12) is fitted into the attaching hole 83 and fixed. The collimator lens 13 (14) is held by a lens barrel 85. The outer circumferential portion of the lens barrel 85 is formed with a male screw portion 86. The inner circumferential wall of the attaching hole 84 is formed with a female screw portion 87. The male screw portion 86 of the lens barrel 85 meshes with the female screw portion 87 of the attaching base 81. With this arrangement, the lens barrel 85 is held by the attaching base 81 so that it is movable in the axial direction of the attaching base 81.

Detailed Description Text (189):
(Depth adjusting structure 1 for adjusting a depth by the write unit or the image forming unit).

Detailed Description Text (190):
The aforementioned example has adjusted the beam waist by moving the collimator lens 13 and 14 in the optical axis direction. This variation, as shown in FIG. 33, is provided with guide holes 88a and screw attaching portions 88b extending in the height direction of the main body constitution wall 57. The write unit constitution wall 1b is provided with guide pins 89, which are loosely fitted into the guide holes 88a. The write unit 1 is urged upward by the urging force of tension springs 90 through the guide pins 89. On the other hand, the screw attaching portions 88b are provided with screw portions 92, which in turn mesh with adjusting screws 91. The point end portion 91a of the adjusting screw 91 abuts on the guide pin 89. If the adjusting screws 91 are rotated to adjust the gap between the write unit 1 and the image forming unit 53, the optical path length will be varied and therefore the position of the beam waist is adjusted with respect to the surface 26 of the photosensitive drum 25.

Detailed Description Text (191):
(Depth adjusting structure 2 for adjusting a depth by the write unit or the image forming unit)

Detailed Description Text (192):
The first depth adjusting structure is provided with the adjusting screws 91 to adjust the gap between the write unit 1 and the image forming unit 53. In a second depth adjusting structure, as shown in FIG. 34, the main body constitution wall 57 is provided with an adjusting knob 94. The shaft portion 95 of the adjusting knob 94 is provided with an eccentric cam 96. On the other hand, the write unit 1 is provided with an abutting portion 97, which in turn abuts on the cam surface 96a of the eccentric cam 96. The abutting portion 97 is brought into contact with the cam surface 96a by tension springs 90 each provided between a stop pin 93 and a guide pin 89. If the optical path length between the write unit 1 and the image forming unit 53 is changed by rotating the adjusting knob 94, the positional adjustment of the beam waist can be performed with respect to the surface 26 of the photosensitive drum 25.

Detailed Description Text (194):
In this example, although the write unit 1 is moved in the vertical scanning direction, the image forming unit 53 may be moved.

CLAIMS:

h e b b g e e e f e e g

1. An adjustment apparatus comprising:

a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source;

an image forming unit incorporating at least said latent image carrier; and

moving means for moving either one of said write unit or said image forming unit relatively along a horizontal scanning direction in order to adjust an offset quantity of said light beam in said horizontal scanning direction.

2. The adjustment apparatus as set forth in claim 1, wherein said image forming unit is provided with a developing unit.

3. The adjustment apparatus as set forth in claim 1, wherein said moving means is constituted by a guide hole formed in a main body constitution wall of an image forming device and extending lengthwise in said horizontal scanning direction, and a support pin formed in either said write unit or said image forming unit and fitted into said guide hole.

4. The adjustment apparatus as set forth in claim 1, wherein said moving means is constituted by an adjusting screw for moving either said write unit or said image forming unit in said horizontal scanning direction, and elastic means for urging either said write unit or image forming unit moved by said adjusting screw so that a point end of said adjusting screw abuts on said unit.

5. The adjustment apparatus as set forth in claim 1, wherein said moving means is constituted by an adjusting screw for moving either said write unit or said image forming unit in said horizontal scanning direction and a boss portion provided in either said write unit or image forming unit moved by said adjusting screw, said adjusting screw meshing with said boss portion.

6. An adjustment apparatus comprising:

a write unit incorporating an optical scanning system to form an electrostatic latent image on a surface of a latent image carrier by a light beam emitted from a laser light source;

an image forming unit incorporating at least said latent image carrier; and

moving means for moving one of said write unit or said image forming unit relatively along a vertical scanning direction defined as a direction perpendicular to both a traveling direction of a light beam which is incident from said write unit toward said image forming unit and a horizontal direction in order to adjust an offset quantity of the light beam in said vertical scanning direction.

7. The adjustment apparatus as set forth in claim 6, wherein said image forming unit is provided with a developing unit.

8. The adjustment apparatus as set forth in claim 6, wherein said moving means is constituted by a guide hole formed in a main body constitution wall of an image forming device and extending lengthwise in said vertical scanning direction, and a support pin formed in either said write unit or said image forming unit and fitted into said guide hole.

9. The adjustment apparatus as set forth in claim 6, wherein said moving means is constituted by an adjusting screw for moving either said write unit or said image forming unit in said vertical scanning direction and elastic means provided in

either said write unit or image forming unit moved by said adjusting screw, the elastic means being used for urging the moved unit so that a point end of said adjusting screw abuts on said unit.

10. The adjustment apparatus as set forth in claim 6, wherein said moving means is constituted by an adjusting screw for moving either said write unit or said image forming unit in said vertical scanning direction and a boss portion provided in either said write unit or image forming unit moved by said adjusting screw, said adjusting screw meshing with said boss portion.

11. An adjustment apparatus comprising:

a write unit incorporating both an optical scanning system and a synchronous sensor for determining a write timing period with respect to a latent image carrier in order to form an electrostatic latent image on a surface of said latent image carrier by a light beam emitted from a laser light source; and

moving means for moving said synchronous sensor in a horizontal scanning direction in order to adjust an offset quantity of the light beam of said write unit with respect to said latent image carrier in said horizontal scanning direction.

13. An adjustment apparatus which comprises optical path length adjustment means for moving at least either an image forming unit or a write unit so that a space therebetween is increased or decreased, in order to adjust an optical path length between a laser light source and a writing object surface of said image forming unit and based on a beam waist position correction quantity obtained by a light beam characteristic evaluation method comprising the steps of:

(a) lighting said laser light source of a light beam which is employed to scan said writing object surface of said image forming unit linearly during a scanning period equivalent to 1 dot;

(b) moving an area-type solid-state imaging element which detects said light beam in order along a traveling direction of said light beam with said writing object surface as a reference position, thereby obtaining a beam image at each position by said area-type solid-state imaging element;

(c) based on each beam image obtained by said area-type solid-state imaging element at each position in a traveling direction of said light beam, computing a beam diameter at said each position of said light beam and thereby computing a beam diameter with respect to a depth direction;

(d) from said beam diameter and a depth, computing a depth curve representative of a relation of said beam diameter to said depth;

(e) specifying a beam waist position on the basis of said depth curve; and

(f) from a difference between said beam waist position and said reference position, computing said beam waist position correction quantity.

14. The adjustment apparatus as set forth in claim 13, wherein in order to change an optical path length between a surface of a latent image carrier of said image forming unit and said write unit, said optical path length adjustment means is constituted by a guide hole formed in a main body constitution wall of an image forming device and a guide pin formed in either said write unit or said image forming unit and fitted into said guide hole.

16. The adjustment apparatus as set forth in claim 15, wherein:

said laser light source is equipped with a semiconductor laser for emitting a light

beam, a collimator lens for collimating said light beam, and a lens barrel for holding said collimator lens;

said lens barrel is formed with a first screw portion along an optical axis direction;

a constitution wall of said write unit is formed with a second screw portion at a position at which said lens barrel is arranged, said first screw portion meshing with said second screw portion; and

said optical path length adjustment means is constituted by said first and second screw portions.

h e b b g e e e f e e g

L2: Entry 75 of 125 File: USPT Aug 8, 1989

DOCUMENT-IDENTIFIER: US 4855785 A
TITLE: Trimming copying machine

Application Filing Date (1):
19880720

Brief Summary Text (7):
The above and other objects of the present invention are achieved by providing an improved trimming copying machine which, being of the conventional type as far as it feeds a copy paper corresponding to the scanning of an original document in one direction, comprises end distance setting means for setting the distance between the starting position of the scan and the backward edge of the specified area, calculating means for obtaining a difference by subtracting the length of the copy paper in the direction of the scan from the product of the aforementioned distance and specified magnification, and paper feed delay means for delaying the timing for starting to feed to copy paper by a time period which corresponds to the aforementioned difference, if this difference is positive.

Drawing Description Text (2):
The accompanying drawings, which are incorporated in and form a part of the specification, illustrate an embodiment of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:

Detailed Description Text (2):
In FIG. 1 wherein symbols defined above in connection with FIG. 5 indicate equivalent or similar parts and values, numeral 1 generally indicates a trimming copying machine embodying the present invention. A portion of the original document G placed on the glass plate 2 is optically taken out by means of a mirror 3, etc. and is made incident into a zoom lens 4 which forms a slit-like image on the surface of a photosensitive body 5. The mirror 3, etc. move in the direction of the arrow .alpha. to scan the entire surface of the document G and the photosensitive body 5 correspondingly rotates in the direction of the arrow .beta. such that the image of the entire document G is formed on the photosensitive body 5. Magnification of the image is determined by the magnification by the zoom lens 4 and also by the ratio between the scanning speed of the mirror 3, etc. and the speed of rotation of the photosensitive body 5.

Detailed Description Text (3):
The image formed on the photosensitive body 5 is an electrostatic latent image which is made visible as a toner image by a developing device (not shown). When trimming is effected, static charge is erased by means of a charge erasing device (not shown) everywhere except for a predetermined specified area such that the image becomes visible as a toner image only in such a specified area.

Detailed Description Text (4):
Copy paper is taken out of a paper cassette 6 by the operation of a feeder roller 7. After it is made to wait by stopping rollers 8 so that its motion will be synchronized with the rotation of the photosensitive body 5, it is moved at the same speed as the speed of rotation of the photosensitive body 5. In other words,

if l.sub.1 is the distance between the image forming point I.sub.1 on the photosensitive body 5 corresponding to the starting position g.sub.1 of the scan and the image transfer section 9 and if l.sub.2 is the distance between the stopping rollers 8 and the image transfer section 9, the paper waits at the stopping rollers 8 until the photosensitive body 5 rotates by l.sub.1 -l.sub.2 before it is advanced to the photosensitive body 5. This is how the position on the photosensitive body 5 corresponding to this starting point g.sub.1 of the scan is made to coincide with the forward edge of the paper. The toner image on the photosensitive body 5 is transferred onto the paper at the transfer section 9. The transferred image is fixed thereafter and this completes the process of copying.

Detailed Description Text (7):
When a print switch is pressed thereafter, the microcomputer 12 switches on the feeder roller 7 and a sheet of copy paper is taken out of the paper cassette 6 (S1). When the paper reaches the position of the stopping rollers 8, it is made to wait (S2) and the mirror 3, etc. are moved in the direction of the arrow .alpha. to start a scan (S3). The motion of the zoom lens 4 and the rotation of the photosensitive body 5 are also started simultaneously. Next, the distance l' and the magnification M are multiplied together (S4) and the distance L of the copy paper P in the direction of the scan is subtracted from the product l'M and it is checked whether the difference thus calculated is positive or negative (S5). If the product l'M is not greater than L, the backward edge b.sub.2 of the enlarged image B would be on the left-hand side of the backward edge p.sub.2 of the paper P. Thus, the paper is held at the stopping rollers 8 for a time period given by (l.sub.1 - l.sub.2)/V.sub.0 where V.sub.0 represents the speed by which the paper is transported to the photosensitive body 5 (S6 to S8). This situation is no different from the operation by a conventional trimming copying machine.

Detailed Description Text (9):
The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and many modifications and variations are possible in light of the above teaching. Such modifications and variations that may be apparent to a person skilled in the art are intended to be included within the scope of the invention.

CLAIMS:

1. In a trimming copying machine for producing a copy from a document by scanning said document and feeding a copy paper sheet in correspondence therewith, said machine being capable of copying only a specified area of said document, the improvement wherein said trimming copying machine comprises

input means for setting a first distance indicative of a first position on a document along a predetermined scan direction where a scan of a specified area of said document along said scan direction is to be started, a second distance indicative of a second position on said document along said scan direction where said scan is to end, a length L indicative of the size of a copy paper sheet along said scan direction and a magnification M,

calculating means for determining a value L' indicative of the length of said specified area of said document along said scan direction and calculating a difference L'M-L' and

adjusting means for adjusting the starting time for feeding said copy paper if said difference is positive such that an image of said specified area of said document is formed entirely within the area of said copy sheet.

L2: Entry 76 of 125 File: USPT Aug 1, 1989

DOCUMENT-IDENTIFIER: US 4853748 A
TITLE: Variable magnification copier

Abstract Text (1):
With a variable magnification copier of this invention, not only magnification but a reference position in the direction of scan is specified such that the image formed on a copy paper sheet is not automatically enlarged with respect to the front edge of the original document to be copied. The difference between the time to start a scan and the time to feed copy paper is controlled such that the enlarged image will not stick out of the paper.

Application Filing Date (1):
19880707

Brief Summary Text (2):
This invention relates to a copier with variable magnification means and more particularly to a copier with which the user can set a reference position such that an image can be formed with magnification varied with respect to this reference position. In other words, a copier of the present invention allows the user, after an original document to be copied is placed on its document table, to specify a position in the direction of the scan or a position on the document with respect to which enlargement or reduction is to be effected.

Brief Summary Text (3):
Variable magnification copiers have been in use but if use is made of a copy paper sheet of the same size as the original document to make an enlarged copy with a prior art copier, a back portion (with respect to the direction of scan) of the image sticks out of the paper and is not copied. This is illustrated in FIGS. 8(A) and 8() by way of an example wherein it is desired to obtain an enlarged copy of a portion (indicated by a shaded rectangular area) of a document with its front edge at distance l from the front edge of the document as shown in FIG. 8(A). If this area of interest is sufficiently near the back edge of the document and if the desired magnification M is sufficiently large, the enlarged image of the area of interest (indicated by a large shaded rectangle) may partially stick out of the normally placed copy paper which is assumed in this example to be of the same size as the original document as shown in FIG. 8(B). This occurs because the front edge of the document is treated as the reference position for the magnification such that the front edge of the image of interest is at the distance of lM from the front edge of the copy paper sheet. With a prior art copier, therefore, it is necessary to place the original document somewhere away from the normal document position on the document table. Similarly, if a copy paper sheet of the same size as the original document is used with such a prior art copier to obtain a copy reduced in size, the image of an area of interest is formed near the front edge of the copy paper sheet. This is again because the reference position for reduction is at the front edge of the document. If it is desired to leave some space along an edge of the copy paper, for example, for the purpose of binding, the original document again must be placed somewhere away from the normal document position.

Drawing Description Text (2):
The accompanying drawings, which are incorporated in and form a part of the

specification, illustrate an embodiment of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings:

Detailed Description Text (2):
Positional relationship between a document to be copied and an enlarged copy thereof obtained on a copy paper sheet by a copier of the present invention is illustrated by FIG. 1(A) which shows the document and FIG. 1(B) which shows the copy paper of the same size as the document. The shaded area in FIG. 1(A) represents an area of interest and only this area is selectively copied on the paper by a process called "trimming". The distance between the front edge of the document (with reference to the direction of the scan) and the reference position is designated by L. As shown in FIG. 1(B), the image obtained on the copy paper is enlarged (magnification M) with respect to the reference position which is also at a distance L from the front edge of the copy paper sheet.

Detailed Description Text (13):
The acceleration time Tm at arbitrary magnification M=m can be obtained by the following formula:

Detailed Description Text (18):
Various components of the copier such as the fixing device (not shown) are warmed up (n30) and initialized (n31). Input data from the keyboard 103 are accepted thereafter (n32) and copying is effected according to the data thus received. The keyboard 103 typically includes keys for setting distances L and l as defined with reference to FIGS. 1(A) and 1(B) as well as magnification M. Values of these parameters are set by operating these keys (n35-n39). If a print key (not shown) is operated after these values are set (YES in n33), the time difference between when the optical unit is started and when the PSC is switched on is calculated according to the conditions thus set. If M is greater than or equal to 1 (YES in n40) and lM is equal to or less than L (NO in n41) and equal to or less than K (NO in n42), for example, T.sub.a is set in a timer TPSC (n43) and a flag FM is set (n51) to indicate that the operation is in a mode wherein the PSC is switched off after the optical unit is started. If M is less than 1 (NO in n40) and l.sub.1 -l.sub.2 is equal to or less than L(1-M) (NO in n46), as another example, T.sub.e is set in another timer TMR (n48), a value Tm indicative of the timing for starting the optical unit is calculated from the input value of M and set (n49) and the aforementioned lag FM is reset (n50).

Detailed Description Text (21):
The foregoing description of a preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and obviously many modifications and variations are possible in light of the above teaching. For example, m.sub.1 and m.sub.2 in FIGS. 4 and 5 need not be the maximum and minimum magnifications because the relationship between magnification and acceleration time is linear and the equation for the straight line shown in FIG. 5 can be determined by selecting any two magnifications and by proceeding similarly as described above. FIG. 3 disclosed a copier of the type with an optical unit which moves with respect to the original document to be copied which remains stationary during a scanning operation but the present invention is applicable also to a copier of the type with a fixed optical unit with respect to which original documents to be copied are moved. Any such modifications and variations that may be apparent to a person skilled in the art are intended to be included within the scope of this invention.

CLAIMS:

1. A variable magnification copier comprising

a scanning means for performing an optical scan of an original document and forming

on a photoreceptor an image of said original document,

input means for inputting a reference position indicating the position of a target image on said original document, a length value indicating the extension of said target image on said original document in the direction of said scan and a magnification value at which said target image is to be enlarged or contracted by said copier,

paper transporting means for delivering a copy paper sheet to an image transfer position,

image transfer means for transferring an image from said photoreceptor to a copy paper sheet at said image transfer position,

control means for automatically controlling the timing by which said paper transporting means delivers a copy paper sheet to said image transfer position with respect to the timing at which said scan is performed according to said reference position, said length value and said magnification value inputted through said input means such that an image of said target image formed on a copy paper sheet delivered by said paper transporting means at a magnification indicated by said magnification value inputted through said input means is not lost at all from said copy paper sheet.